



Water planning in a changing climate: Joint application of cost utility analysis and modern portfolio theory

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Year: 2011
Journal: Environmental Modelling & Software : With Environment Data News. 26 (1): 18-29

Abstract:

High nutrient loads are a widespread problem for many rivers and river catchments and cause damage to various ecological assets. Negative effects can be mitigated by changes in land management such as land use changes and/or implementation of intervention measures such as - amongst others - the construction of artificial wetlands and water treatment plants. Usually budget constraints limit the number of measures that can be implemented by catchment management authorities which creates an optimisation problem, namely maximising the total water quality benefits subject to a budget constraint. Here we present a case study from the Ellen Brook catchment in Perth, Western Australia, which suffers from serious waterway health problems. We evaluate a variety of suggested intervention measures and determine the benefits they return. Cost utility analysis (CUA) and subsequent combinatorial optimisation are employed to determine a portfolio of intervention sites that returns the maximum aggregated benefit subject to a budget constraint. Shortcomings in this approach are identified when future uncertainties are to be accounted for and we perform a comparative study using modern portfolio theory (MPT). It is demonstrated how MFT and CUA can be jointly used to consistently account for triple bottom line aspects and aspects of future uncertainties such as uncertainties in future climate variability. (C) 2010 Elsevier Ltd. All rights reserved.

Source: <http://dx.doi.org/10.1016/j.envsoft.2010.03.001>

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES), Other Climate Scenario

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1

Other Climate Scenario: A1B

Communication:

resource focus on research or methods on how to communicate or frame issues on climate change;
 surveys of attitudes, knowledge, beliefs about climate change

A focus of content

Climate Change and Human Health Literature Portal

Other Communication Audience: Water planners

Exposure : 

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Quality

Food/Water Quality: Chemical

Geographic Feature: 

resource focuses on specific type of geography

Freshwater

Geographic Location: 

resource focuses on specific location

Non-United States

Non-United States: Australasia

Health Co-Benefit/Co-Harm (Adaption/Mitigation): 

specification of beneficial or harmful impacts to health resulting from efforts to reduce or cope with greenhouse gases

A focus of content

Health Impact: 

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Intervention: 

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation: 

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: 

type of model used or methodology development is a focus of resource

Cost/Economic, Exposure Change Prediction

Resource Type: 

format or standard characteristic of resource

Research Article

Timescale: 



time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content